

**OFFICE OF AEROSPACE STUDIES**  
**ANALYSIS OF ALTERNATIVE (AOA)**  
***GUIDANCE IN SUPPORT OF AFI 10-601 (Revised 22 September 2003)***

**Analysis of Alternatives (AoA) Definition.**

An AoA is an analysis of the operational effectiveness and estimated life cycle costs for alternative materiel systems required to meet or eliminate identified gaps/shortfalls in operational capabilities or mission needs.

The AoA provides the rigorous analysis and foundation needed to develop and support meaningful requirements development and acquisition processes, and normally, supports a Milestone decision. Additionally, the AoA supports detailed development of documents, like the Initial Capabilities Document (ICD), the Capabilities Development Document (CDD), and the Capabilities Production Document (CPD).

The ICD, CDD, and CPD, normally provide a problem statement for the AoA that helps focus and support a firm foundation for the analysis to be executed, developing answers to the Milestone Decision Authority's (MDA's) issues. Also, the AoA documents the analytical and operational rationale for choosing the preferred alternative(s) materiel system(s) and the necessary capabilities they provide to meet a mission need.

The AoA also provides the means to establish Measures of Effectiveness (MOEs) for the materiel system(s), with the required values for operational capabilities requirements (thresholds and objectives). These MOEs are often stated in terms of military utility, and based on value provided to the warfighters. With these MOEs, one can begin to further identify models, simulations, and other analysis tools required to execute the study.

**The Purpose of an AoA.**

The AoA provides information that helps the decision makers select the most cost-effective alternative(s), in order to satisfy a mission need or eliminate an operational gap/shortfall in capability. It compares alternative solutions on the basis of operational effectiveness, and cost. It documents the analytical and operational rationale for choosing the preferred alternative(s). It also helps to justify the need for starting, stopping or continuing an acquisition program.

AoAs and other studies also serve as important tools for developing the Stage I and Stage II Initial Capabilities Documents (ICDs), the Concepts of Operational Employment (CONOPS or CONEMP), and Test and Evaluation Plans (TEMPs).

The AoA contributes to the "Warm Base of Analysis" by keeping together the analysis results, tools, methods and data used to support the program over its lifetime.

**Study Types.**

There are a series of studies done to support the requirements development and acquisition process. The first of these studies is a Functional Area Assessment (FAA), followed by a Functional Needs Analysis (FNA). The FAA and FNA represent the capabilities planning process identified in DoDD 5000.1/DODI 5000.2 and the Joint Capabilities Integration and Development System in CJCSM 3170.01/CJCSI 3170.01C, and AFI 10-601.

The output of the capabilities planning process for the Air Force will result in a Stage I ICD (addressing the first five items of the completed ICD). The stage I ICD documents the

broad operational shortfalls in capabilities that will be examined during the Functional Solution Analysis (FSA).

The specific study completed at this point, during the FSA, is called the Analysis of Materiel Approaches (AMA). The AMA normally, considers a broad range of alternatives that could eliminate the gaps/capabilities shortfalls, and documents the findings in ICD Stage II.

Later an AoA may be directed that starts the Concept Refinement Phase, based on the completed information provided in the ICD (Stage II ICD). The AoA is normally done during the Concept Refinement Phase in order to support a Milestone A decision. AoAs may also be done to support Milestones B and C.

## **AMA.**

An AMA considers a broad range of alternative concepts to satisfy a mission need. It defines the performance, operational characteristics and capabilities necessary to accomplish the mission tasks. It identifies which alternatives are clearly unacceptable and which have the potential capability to meet mission needs and requirements.

The cost estimates are made on the basis of life cycle cost (LCC); which includes the costs of research and development (R&D); engineering design, estimates of the costs of investment (Investments); projections of costs for operations and support (O&S); and disposal/decommissioning cost. Normally, at this early stage in the study process, the cost estimates may be done at a Rough Order of Magnitude (ROM) level.

Specialized intelligence support required for a new system should also be reflected in the cost, if known. These early cost estimates will be qualified to highlight their weaknesses and any possibility source for gross errors.

The AMA will identify risk of uncertainties in cost and performance and, to the extent known, the characteristics of each concept that drives the cost and performance associated with each alternative.

The AMA and later AoAs implement Cost as An Independent Variable (CAIV) by developing the initial trade space for cost and effectiveness that can be used in the decision making process. The early cost effectiveness comparisons may allow the MDA to set the original cost objectives for the potential program.

The AMA will also provide direction and focus for the AoA to follow after the ICD Stage II is completed, and will further support the MDA during Milestone A.

## **AoA.**

The AoA is accomplished to analyze and evaluate a very small range of specific hardware/software alternatives, resulting from the AMA. The AoA starts once the technologies to be used and type of alternatives have been selected by the MDA.

Alternatives are based on the solution set identified in the ICD, and focus on how to provide the needed capabilities while reducing cost and risk. The AoA evaluates the cost and operational capabilities during Concept Refinement, and provides an answer to issues the MDA may have at Milestone A.

The AoA establishes acceptable bounds of risk for possible combinations of cost and performance, using point estimates consistent with the cost-estimating techniques appropriate for the alternatives' technical maturity. The AoA further helps to document and refine CAIV objectives. This is done through the development of cost and effectiveness trade spaces for each

alternative, contributing to the decisions made by acquisition personnel and participating MAJCOMs.

AoAs also consider affordability of individual alternatives for Milestone A, examining the impact of continuing or terminating the alternatives being studied. AoAs may be required to support Milestones B and C, based on the needs of the MDA, and as documented in the Acquisition Decision Memorandum (ADM).

### **Direction.**

Under DoDD 5000.01/DoDI 5000.02, AoAs are required for all ACAT I programs and may be directed for ACAT II and III programs.

The MDA makes all final acquisition program decisions. When the MDA determines that an AoA is required to support the next milestone he/she issues an ADM requiring an AoA.

The ADM provides guidance on the required scope and level of detail in the AoA. Air Force tasking for AoAs will be provided to organizations in the form of a Program Management Directive (PMD).

The MDA also may direct an update of an existing AoA for Milestones B and C, if the threat or mission changes, or if new information on performance or cost is needed.

In AoAs which OSD/PA&E has a major role, they will provide direction, guidance and review, of the AoA Study Plan and Final Results, in support of the MDA.

The AoA is subject to tailoring and streamlining based on the type and size of the program, maturity of the system concepts, and other considerations as determined by the MDA. An AoA should be sized and scoped for the MDA in light of the issues he or she needs answered.

Not all AoAs are the same, some are more focused and will be smaller in scope, and others may address complex overarching issues, and will be much larger studies. If the MDA has no complex issues, or fully understands the issues that may arise at the Milestone, they may waive or eliminate the need to do an AoA.

### **Improving the AoA Process.**

In order to improve the quality and consistency of AoAs, we need to ascertain if the information being generated in AoAs makes a meaningful contribution to the decision making process.

In order to determine this, OSD/PA&E, SAF/AQ and the Office of Aerospace Studies (OAS) should work together to address and document pre-AoA conditions and the possible decisions that would be facilitated before starting an AoA. Later, upon completion of the AoA, and presentation of the results to the MDA, OSD/PA&E, and SAF/AQ; OAS will assess the value resulting from accomplishing the AoA.

Items demonstrating AoA value may include: (1) did the AoA effect the decision, (2) did the AoA allow the MDA to make a different decision, (3) was there an appropriate use of AoAs, (4) was the analysis complete? Based on the results provided, we should be able to identify changes needed to improve the AoA process.

### **AoA Reviews.**

The Air Force Requirements for Operational Capabilities Council (AFROCC), and the Air Force Council if necessary, reviews and validates AoA study plans, midterm status, and draft final results. Also, the AFROCC may direct AoA products be presented to a specific Air Force

Group or Board. This action would normally be accomplished to promote advocacy or enhance corporate understanding of the particular program supported by the AoA.

The information presented in Table 1-1 should help in determining what reviews are needed for the AoA process. Note in the table C1-1 where it shows items as having to be “Approved to go to OSD” by AF/CV, refers to the formal documents. It is expected that work at the Action Officer level would be an ongoing process, and the sharing of information would have started as early earliest as possible. This would also be true of sharing information with all stakeholders with an interest in the study.

**TABLE C1-1. The AoA Review and Approval Process.**

	<b>MAJCOM</b>	<b>AFROCC</b>	<b>AF/XOR</b>	<b>AF/XO</b>	<b>AF/CV</b>	<b>JROC</b>	<b>PA&amp;E</b>	<b>MDA</b>
<b>ACAT I Study Plan</b>	Reviews All	Reviews All	Coord on package	Coord on package	Approve to go to OSD	Not normally req'd*	Review prior to AoA initiation**	Approve
<b>ACAT II/III Study Plan</b>	Reviews All	Reviews All	ACAT III Air Staff validation	ACAT II Air Staff validation	Not normally req'd*	Not normally req'd*	Not normally req'd**	Approve
<b>ACAT I Midterm Status</b>	Reviews All	Reviews All	Reviews ALL	Reviews ALL	As Required	As Required	As Required	As Required
<b>ACAT II/III Midterm Status</b>	Reviews All	Reviews All	Reviews ALL	Reviews ACAT II	Not normally req'd	Not normally req'd*	Not normally req'd	Not normally req'd
<b>ACAT I Final Results</b>	Reviews All	Reviews All	Coord on package	Coord on package	Approve to go to OSD	Validate Results	Review at least 60 days prior to M/S B	Approve
<b>ACAT II/III Final Results</b>	Reviews All	Reviews All	ACAT III Air Staff validation	ACAT II Air Staff validation	Not normally req'd*	Not normally req'd*	Not normally req'd	Approve

\* JROC Special Interest Programs may require JROC presentation; Joint Impact Programs may require an FCB presentation.

\*\* PA&E shall review the AoA Study Plan prior to taking it to the AFROCC. This will ensure that the analysis planned addresses issues important to PA&E and the MDA, and represent an executable analysis approach.

- The document sponsor must ensure that PA&E is included as early as possible in AoA development
- The document sponsor is responsible for ensuring AoA "documents" are staffed in a timely manner to meet DoDD5000.1 and DODI 5000.02 requirements
- The Air Staff Subject Matter Expert should assist in staffing the package through appropriate channels to XOR/XO/VCSAF as appropriate. Some AoAs may require a presentation to either the Air Force Council, and the VCSAF or both prior to approval for release to OSD.
  - Staffing of ACAT II/III AoA "documents" beyond XOR/XO is determined on a case-by-case basis

If the nature of the AoA is extremely technical or politically sensitive, either the MAJCOM or the AFROCC may request a formal technical assessment by the Technical Review Group (TRG). OAS and AFSAA will help the AoA Study Director schedule reviews with the TRG, and followed by the AFROCC, (and AF Council if necessary).

If an AoA midterm status briefing is not required outside of Air Force channels, and the AoA study is proceeding as originally intended, the study team may request the AFROCC waive the requirement to present the midterm status update.

All ACAT I and selected special interest ACAT II study plans, midterm reviews, and final results for Air Force or Joint AoAs, for which the Air Force is the lead service, must have AF/CV approval before being briefed to OSD. On approval by AF/CV, information will be forwarded to working level IPTs, the Overarching Integrated Product Team (OIPT), the Defense Acquisition Board (DAB), and/or equivalent higher bodies. The AF/CV through AF/CVA is the approval authority for modifications to this AF review process (e.g., for special access programs). If the AoA results are being forwarded to OSD/PA&E, the Final Results/Final Report on the study must be submitted 60 days before the scheduled Defense Acquisition Board (DAB) or Information Technology Acquisition Board (ITAB). The AoA schedule should be structured to accommodate the time line needed to get the AoA Final Results/Final Report out to OSD.

### **Technical Review Group (TRG).**

The TRG assesses ACAT I, selected ACAT II or ACAT III AoAs for technical adequacy and completeness of the analytical approach and results when requested by the MAJCOM study team or the AFROCC. The Director, Air Force Studies and Analysis (AFSSA), will chair the TRG. The Air Force Operational Test and Evaluation Center (AFOTEC) is responsible for reviewing the linkage between the TEMP and ICD, (as outlined in the AoA final report) and for presenting a linkage assessment to the TRG. In the absence of the TRG, the Office of Aerospace Studies (OAS) will perform technical assessments.

### **AFROCC and AF Council.**

On occasion, the AFROCC may determine that if it is appropriate for the Air Force Council to review the AoA study plan, midterm, or the final results. To ensure proper representation on specific issues, the AFROCC, through AFSAA, may provide attendance recommendations to AF/CVA.

The AFROCC may recommend that AF/CV approve the AoA study plan, midterm, or final results without going to the AF Council. AF/CV will make the final decision. The senior Air Force members of the OIPT should be invited to the AFROCC, as well as AF Council reviews of AoAs.

If the Air Force is identified as the lead service for a Joint Program, AoA members from the other services and OSD/PA&E may be invited to the AFROCC and AF Council, to ensure their interests and perspectives are addressed, when the AoA information is presented.

### **Integrated Product Teams and AoAs.**

DoDD 5000.1/DoDI 5000.2 and associated interim guidance refer to three levels of Integrated Process Teams. The Overarching IPT (OIPT) provides top-level oversight and review, adjudicates issues, and advises the MDA on acquisition issues. The Integrating IPT (IIPT) integrates critical aspects of the program. A specific Working-level IPT (WIPT), usually the Cost Performance IPT (CPIPT), works AoA issues. The WIPTs may establish working

groups (WGs) to perform specific tasks, such as oversight of the study team formed to conduct the AoA.

### **Air Force AoA Center of Expertise.**

AFMC's Office of Aerospace Studies (AFMC/OAS) is the Air Force Center of Expertise (COE) for AoAs. The AoA COE supports the MAJCOM study director in helping administer, plan, execute, and facilitate AoAs and their reviews.

OAS is also responsible for the AF AoA training courses and AoA Handbook, which provides detailed guidance on how to accomplish an AoA. OAS' role is also described in the AoA Handbook. In cases where the MAJCOM elects not use a TRG, OAS will provide the AFROCC with an assessment of the AoA products.

To support the AoA planning process, OAS will work with the MAJCOMs to document and track AoA costs, including M&S costs occurring during the study, the number of resources expended, cost of contractor support, and cost of travel and administrative support used during the study.

### **Execution of the AoA.**

The lead MAJCOM is responsible for executing the AoA. The MAJCOM will appoint a Study Director and assemble the AoA study team. OAS will appoint an assistant to the AoA Study Director.

The MAJCOM Study Director is the focal point for all study activities and exercises overall responsibility for these efforts. The Study Director is responsible for ensuring that the study team functions under the IPT process.

The AoA study team is composed of members from the MAJCOM staff, Air Staff, support commands, OAS, contractors, and others services and government agencies as necessary.

For joint programs, if the AF is designated as the lead service, Study Team membership will include representatives from the appropriate services, (who may or may not be designated as study co-leads).

OSD/PA&E participation on the AoA study team is strongly encouraged. In cases where OSD/PA&E do not have members on the study team, the Study Director is encouraged to maintain face-to-face communications with action officer and management levels throughout the study.

### **Study Plan.**

The AoA study team will develop a study plan of sufficient detail to address the issues established by the MDA and to ensure a rigorous analysis process. The study plan is intended to be a living document and should be updated periodically. The AoA study plan should follow a format similar to the final report found in the AoA Handbook, which can be obtained from the OAS Web site [www.oas.kirtland.af.mil](http://www.oas.kirtland.af.mil)). AoA study plans must be reviewed and validated by the AFROCC. OSD/PA&E will review and assess ACAT ID, ACAT IM AoA study plans or any other plans under their purview.

### **Final Report.**

The final report and briefing of final results will be developed by the MAJCOM and forwarded through AFROCC, XOR, XO and AF/CV to OSD DPA&E at least 60 days prior to

the DAB. The final report is to document work done, and to help establish support for the new program, and help the MDA address issues they may have about the program. The MAJCOMs should submit a copy of the AoA Final Report to (1) the Defense Technical Information Center (DTIC), (2) the System Program Office and (3) OAS. The MAJCOM shall also prepare and deliver all Distributed Product Description (DPD) data and models accredited for use in the AoA as directed per AFI 16-1002.

### **AoA Planning.**

Once a year, AFSAA, and OAS will sponsor an AoA Planning Conference for the using commands and other appropriate agencies to discuss AoA issues and projected AoA activities for the next two years. Information gathered at this conference should be documented in a multi-year forecast that will be used for budgeting and other AoA planning efforts.

A critical use of this multi-year forecast is to identify potential data and Modeling and Simulations (M&S) needs for future AoAs. To provide for this forecasted need for data, supportive information should be included in the Acquisition M&S Master Plan, to allow the tools and data to be ready at the AoA start.

### **AoA Handbook.**

Additional guidance on the AoA process, organization, execution, reporting, and review is available in the Air Force AoA Handbook obtained from the AFMC/OAS web site ([www.oas.kirtland.af.mil](http://www.oas.kirtland.af.mil)), or from the OSD On-Line Deskbook.

### **Standard Models and Methodologies.**

Every attempt should be made to use accepted Air Force models, simulations, databases, and methodologies. The standard "Suite of Analytical Models" in the Air Force Standard Analysis Tool Kit is listed in the AoA Handbook.

The standard electronic methodology for campaign worth analysis was developed through the SAF Electronic Warfare Partnership Process and is based on standard Air Force baselines that are available from the Air Force Studies and Analyses Agency (AFSAA). Therefore, electronic combat AoAs will include assessment of campaign level military worth developed through the SAF Partnership Process and based on the standard Air Force campaign baseline.

### **AoA Scenarios, and Data.**

AoAs require viable scenarios and Intelligence data in order to accomplish the rigorous analysis needed. This requires AFSAA involvement to ensure appropriate scenarios and data are developed for the AoAs.

Likewise, through the AoA process, the Intelligence Community and the USAF can provide keen insights and significant Intelligence details associated with potential new weapon systems and technologies coming into use. This should provide a baseline for future Intelligence requirements that will be driven by procurement of new weapon systems.